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Annual Levels of Immigration and Immigrant Entry Earnings in Canada

by Feng Hou and Garnett Picot

Social Analysis Division
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0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
E	use with caution
F	too unreliable to be published
*	significantly different from reference category ($p < 0.05$)

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Abstract

The annual level of immigration is one of the most critical components of a country's immigration policy. It is difficult to directly compare the costs and benefits of changing immigration levels because immigration can serve multiple goals. However, some narrowly-defined effects can be empirically assessed. This study considers solely the potential influence of immigration levels on immigrant entry earnings. Using the Longitudinal Immigration Database (IMDB) over the 1982-to-2010 period, this study finds that a 10% increase in the size of a cohort of entering immigrants is associated with a 0.8% decline in real entry earnings among immigrant men and a 0.3% decline among immigrant women in that cohort when controls for changes in immigrant characteristics and macroeconomic conditions are applied. These effects are consistent across the immigrant entry earnings distribution, although somewhat weaker at the very top. These results also show that the effect of cohort size on entry earnings does not vary with general macroeconomic conditions.

Executive summary

The annual level of immigration is one of the most critical components of a country's immigration policy. Whether the current level of immigration is appropriate for the Canadian economy and society and for immigrants themselves is the subject of ongoing debate. It is difficult to settle the debate since immigration serves multiple goals as diverse as nation building and meeting local labour demand. Consequently, the various costs and benefits of changing immigration levels often cannot be compared on the same scale. In-depth analyses of the economic and societal impacts of immigration levels and their implications for future policy directions are rare in Canada. While most broad, long-term impacts are difficult to quantify, some narrowly-defined effects can be empirically examined.

This study focuses on the effect of immigration levels on one aspect of immigrants' labour market outcomes—their entry earnings, i.e., earnings during the first two full years in Canada. An increase in labour supply—that is, a larger immigrant entering cohort—could increase competition for the types of jobs sought by entering immigrants and place downward pressure on wages for immigrants arriving in that cohort. This study asks two questions: (1) Do immigration levels affect immigrant entry earnings, after differences among cohorts in macroeconomic conditions and immigrant demographic characteristics are taken into account?; (2) Does the association between entry earnings and immigration levels vary with economic conditions at time of landing? In other words, is the effect of the immigration level stronger during economic downturns and weaker during economic expansions?

The individual-level data for this study are drawn from Longitudinal Immigration Database (IMDB), which covers the years from 1982 to 2010. The analysis includes immigrants who (1) were aged 25 to 54 at time of entry to Canada, (2) obtained their permanent residence status between 1980 and 2009, and (3) had at least $1000 (in 1982 constant dollars) in paid employment earnings in any year of their first two full years in Canada. The sample size is about 1.75 million person-years for men and 1.35 million person-years for women.

The focal independent variable—immigration cohort size—is defined as the number of prime-working-age (25 to 54) immigrants in any given year disaggregated by three levels of educational attainment (university degree, some postsecondary education, and high school education or less). Three aggregate variables are used to control for the effect of macroeconomic conditions on the trends in immigrant earnings: the unemployment rate of prime-working-age (25 to 54) males at the year of landing in Canada, the current-year unemployment rates for prime-working-age (25 to 54) males, and the weekly paid-employment earnings of Canadian-born full-year full-time male workers aged 20 to 34. Immigrant landing cohorts and detailed demographic characteristics are also controlled for in the multivariate models.

This study finds a statistically significant association between the size of an entry cohort and entry earnings among prime-working-age immigrants in that cohort. A 10% increase in the immigration level (cohort size) is associated with an average 0.8% decline in real entry earnings of immigrant men and a 0.3% decline in real entry earnings of immigrant women. These effects are consistent across most of the immigrant entry earnings distribution, although somewhat weaker at the very top.

The results also show that the effect of cohort size on entry earnings does not appear to vary with general macroeconomic conditions. Increasing cohort size tends to put downward pressure on immigrants entry earnings in both recessions and economic expansions. Of course, factors other than cohort size that affect immigrant earnings, such as labour demand, will likely differ under different macroeconomic conditions, resulting in different entry earnings levels in recessions and expansions.

1 Introduction

The annual level of immigration is one of the most critical components of a country's immigration policy. Between the 1920s and the late 1980s, the annual intake of immigrants was often related to the state of the Canadian labour market. Immigration was increased considerably during periods of economic expansion and was reduced significantly during periods of extreme economic downturn (Green 2004). A recent example of the link between immigration levels and macroeconomic conditions occurred in the early 1980s. The average intake of immigration was reduced to around 90,000 per year for four consecutive years following the onset of the recession. Since the early 1990s, a historically high level of immigration has been maintained.[1]

Whether the current level of immigration is appropriate for the Canadian economy and society and for immigrants themselves is the subject of ongoing debate. The calls for increased immigration levels often correspond with periods of strong economic expansion, when there is considerable pressure to fill labour shortages. During the periods of recession and slow recovery, however, many question whether inflows of new immigrants should be reduced. Some argue that the current level is beyond the "absorptive capacity" of the economy, citing the deteriorating labour market performance of successive cohorts of new immigrants. For instance, Grady (2009) proposed that the annual intake of immigrants be reduced to as low as 100,000. Conversely, others ask for a sustained increase in immigration, to 350,000 or 400,000 per year, as a strategic measure to counteract the effects of population ageing and the intensification of international competition for skilled labour (e.g.: Conference Board of Canada 2010; Saunders 2012).[2] Between these two views, some economists (e.g.: Abbott and Beach 2011; Picot and Sweetman 2012) have called for a return to a procyclical immigration policy designed to change the distribution of immigration across the business cycle, i.e., reducing the immigration level in recessions and increasing it during economic expansions. It is difficult to settle these debates since immigration serves multiple goals as diverse as nation building, family reunification, responding to humanitarian needs, and meeting localized labour demand. Consequently, the various costs and benefits of changing immigration levels often cannot be compared on the same scale.

This paper restricts its analysis to the impact of immigration levels on immigrants' economic outcomes in their initial years after immigration. Immigrants' labour market performance may be related to the level of immigration because of changes in labour supply. An increase in labour supply—i.e., a larger immigrant entering cohort—could increase competition for the types of jobs sought by entering immigrants and place downward pressure on wages for immigrants arriving in that cohort. Using the Longitudinal Immigration Database (IMDB) over the 1982-to-2010 period, this study attempts to quantify the statistical association between immigration levels and immigrants' economic performance in terms of their entry earnings—i.e. earnings in their first two full years in Canada.[3] Specifically, this study asks two questions: (1) Do immigration levels affect immigrant entry earnings, after differences among cohorts in macroeconomic conditions and immigrant demographic characteristics are taken into account?; (2) Does the association between immigration levels and immigrant entry earnings vary with economic conditions at time of landing? In other words, is the effect of the immigration level stronger during economic downturns and weaker during economic expansions? This paper does not examine any possible effect of immigration levels on the earnings of Canadian-born workers.

1. Immigration levels averaged 220,000 per year in the 1990s and 241,000 per year in the 2000s.
2. The figure 350,000 is close to 1% of Canada's current total population. Annual intake of 1% was the target specified in a 1995 Liberal Party document, *Into the 21st Century: A Strategy for Immigration and Citizenship* (Green and Green 1999, p. 435).
3. The first two full years in Canada for those arrived in 1990, for example, are 1991 and 1992.

The remainder of this paper is organized in four sections. Section 2 reviews the literature on the effect of birth cohort size on economic outcomes in the general population and the impact of the size of the immigrant population on the earnings of Canadian-born workers. Section 3 discusses the data source, measures, and analytical approaches. The results section, Section 4, presents descriptive statistics and multivariate analysis estimates. Section 5 concludes.

2 Cohort size and economic outcomes

Although no studies of the effect of immigrants' entry cohort size on their economic outcomes could be found in Canada and other Western countries, there is a large literature linking the size of individuals' birth cohort with their socioeconomic fortunes. According to Easterlin (1987), who developed the most influential theoretical claims in this literature, the relative cohort size marks a generation for life. "For those fortunate enough to be members of a small generation, life is—as a general matter—disproportionately good; the opposite is true for those who are members of a large generation." (1987, p. 3–4). In particular, Easterlin asserted that the baby boom generation, given its large size relative to the preceding generation, would experience lower earnings and higher unemployment than its parents' generation.

Easterlin's assertion rests on basic notions of labour supply and demand. *Ceteris paribus*, if one assumes that younger workers are poor substitutes for older workers, younger workers of larger cohorts potentially face greater competition in the labour market and encounter greater odds of economic difficulties. Large cohort size could also adversely affect the cohort members' wage growth and career advancement.

A review of over 30 studies published before the mid-1990s consistently found that, in the United States, Canada, and the United Kingdom, larger cohorts were associated with lower real or relative earnings among young workers (Bloom et al. 1988; Korenman and Neuman 2000). Large youth cohorts also tended to be associated with increased relative unemployment in many Western countries. However, there is considerable disagreement regarding whether the supply effects are concentrated in the early years of the work life (Berger 1985; Dooley 1986; Welch 1979). There is also speculation that the cohort size effect could be somewhat offset under favourable economic conditions (Korenman and Neuman 2000).

Studies published since the mid-1990s use data covering longer periods and thus have more reliable estimates as a result of increased variation in cohort size. For instance, Macunovich (1999) found that almost all of the change in the experience premium and a large proportion of the change in the college wage premium over the 1963-to-1995 period are associated with the changing age structure in the United States. Using U.S. data spanning the 1974-to-2004 period, Slack and Jensen (2008) demonstrated a significant association between large cohort size and incidence of underemployment—defined as involuntary out-of-work, involuntary part-time work, and low-earning jobs. In a more recent U.S. study, Macunovich (2011) suggested that changes in relative cohort size accounted for about 60% of the decline in women's starting wages—both in absolute terms and relative to prime-working-age workers—over the 1968-to-1982 period and for 100% of the increase in women's starting wages over the 1982-to-2001 period.

Some recent studies took advantage of variation across nations in the timing and magnitude of changes in youth cohort size. Using cross-national time-series data covering the 1970-to-1994 period in the United States, Canada, and 13 other Western countries, Korenman and Neuman (2000) found that large youth cohorts lead to large increases in the relative unemployment rate of youths. With data from 17 Organization for Economic Cooperation and Development (OECD) countries over the 1960-to-1996 period, Bertola et al. (2007) showed that an increase in cohort size raises youth unemployment rates. Focusing on 11 European countries over the 1994-to-2001 period, Brunello (2010) found that a 10% increase in cohort size is associated with a 0.7%

decrease in hourly earnings for high-school graduates and a 1.7% decrease for college graduates.

The same analytical approach linking cohort size and economic fortunes is believed to not have been applied to the possible association between annual levels of immigration and labour market outcomes for immigrants in the entering cohorts. However, there are reasons to believe that a "cohort size" effect exists. In the literature reviewed above, there is an assumption that, when a young cohort enters the labour market, its members compete primarily with other inexperienced workers in that cohort for entry level jobs. A similar situation exists for entering immigrants. New immigrants bring little or no Canadian work experience, and typically little Canadian education to their job search. They may also have to confront language and cultural issues in the job search. These issues will limit to some extent the types of jobs for which they can compete. This could plausibly result in "recent" immigrants being considered imperfect substitutes for similarly-educated domestic workers, as is found by Card (2009), Manacorda et al. (2012), and Ottaviano and Peri (2012). A recent Canadian study shows that university-educated new immigrants, both men and women, had average earnings in their first five years in Canada similar to those of Canadian-born high-school graduates (Bonikowska et al. 2010).

The degree of substitutability between domestic and immigrant workers may vary across the income distribution. Highly paid immigrants may have the language and other skills needed to more effectively compete with domestic workers, while the lower paid immigrants may lack these necessary skills. Hence, the "cohort size" effect is expected to be weak among highly paid immigrants. Overall, immigrants would compete with other immigrants in their arrival cohort, or with immigrants who have been in Canada a short period of time. This may be particularly true among lower paid immigrants.

In the related literature, numerous studies have examined the effect of immigration on the economic well-being of the domestic-born population. However, the focus of these studies is not annual levels of immigration; rather, they examine the size of the overall immigrant population. To date, there is no consensus regarding the impact of immigration on the labour market outcomes of the native-born (see: Borjas 1999, 2003; Borjas et al. 2012; Card 2001, 2005, 2012). For instance, using six Canadian censuses of population over the 1971-to-2001 period, Aydemir and Borjas (2007) relied on the time variation in the share of immigrants by education–experience groups to identify the impact of immigration on the earnings of the domestic-born. They found that a 10% immigration-induced increase in the labour supply in a particular skill group reduces the earnings of Canadian-born workers in that group by 3%. In comparison, employing various alternative estimation strategies, Tu (2010) analyzed three Canadian censuses over the 1991-to-2001 period and concluded that the effects of immigration on the wages of Canadian-born workers were either not significant or slightly positive.

There is a possible issue of endogeneity in estimating the effect of immigration levels on immigrant entry earnings. Rising wages, for example, would result in increased cohort size. Immigrants may be more motivated to come to Canada when labour market conditions improve. This issue of endogeneity is unlikely to be serious for a number of reasons. First, admission to Canada can take years, so immigrants would have to anticipate future labour market conditions. Second, cohort size is determined primarily by government quotas. Since the early 1990s, these quotas have been independent of economic conditions. Finally, such an endogeneity bias would reduce any negative effect of cohort size on immigrant entry earnings. If it existed, the endogeneity bias would result in an underestimate of any negative effect of cohort size.

3 Data, measures, and methods

3.1 Data

The individual-level data of this study are drawn from the Longitudinal Immigration Database (IMDB). The IMDB combines immigrant landing records and annual tax records for immigrants who have arrived in Canada since 1980. Immigrants who have filed at least one tax return since 1980 are included in the database. From immigrant landing records, the database retains rich information on immigrant characteristics at landing, including age, education, marital status, source country, official-language ability, and immigration category (e.g., skilled workers, family, and refugees). From the tax records, the database derives information on earnings and other income components, taxes paid, current marital status, and geographic location of residence. The tax records currently cover the 1982-to-2010 period, with additional years added as tax records for those years become available.

Immigrants who were aged 25 to 54 at time of entry to Canada and who obtained their permanent residence status between 1980 and 2009 are included. With the restriction on age at immigration, the majority of immigrants in the study would have finished their formal education abroad. A very small number (about 0.1% of the total sample) of immigrants are excluded from the study because information on education, official-language ability, country of birth, or sex is not available. The selected sample size of immigrants arrived in a given year ranges from a low of 32,800 in the 1983 landing year to 146,300 in the 2001 landing year. Only immigrants with at least $1000 (in 1982 constant dollars) in paid employment earnings in any year of their first two full years are included in the sample used in the analysis.[4] The final sample size is about 1.75 million person-years for men and 1.35 million person-years for women.

3.2 Measures

3.2.1 The outcome variable—paid employment earnings

This study uses annual paid employment earnings (wages and salaries) in the first two full years in Canada as an indicator of labour market outcomes among new immigrants.[5] There are three important reasons to focus on immigrants' earnings in their initial years after landing. First, immigrant entry earnings and other initial labour market outcomes are often used as a criterion to evaluate the effectiveness of immigration selection programs and to make policy adjustments (Green and Worswick 2010). Second, economic outcomes during early years after arrival may

4. Setting the minimum earnings threshold to a lower value tends to slightly increase the estimated effect of cohort size. For example, when the threshold was set at $500, the estimated effect of cohort size increased from -0.078 in Model 2 of Table 2 to -0.083. When the threshold was lowered to $50, the estimated effect of cohort size increased to -0.087. However, the estimated effect increased drastically to -0.286 when immigrants with zero earnings (a value of 0.5 is assigned in order to calculate log earnings) are included. There are two possible explanations for this large increase. First, it may capture the additional negative effects of cohort size on the likelihood of employment. Second, it could be an artifact of changes in tax filing patterns. See Footnote 6 for details. Since it is not possible to separate the possible effect of cohort size on employment and the possible impact of changes in tax filing patterns, it is prudent not to use the very large estimated effect. However, it is reasonable to assume that excluding immigrants with zero earnings would underestimate the effect of cohort size because the effect on employment is not reflected. That is, an increase in cohort size may result in both a lower employment rate among immigrants in that cohort, and a fall in earnings among those who are employed. Excluding those with zero earnings would exclude the "employment rate" effect. This study presents the conservative estimates based on a sample of employed immigrants with non-trivial earnings. These results are unlikely affected by changes in tax filing patterns which affects primarily the reporting patterns of individuals with zero or very low earnings.

5. The choice of the first full year, the first two full years, of the first three full years to represent "initial years after immigration" makes little differences to the estimated effect of cohort size. For example, if only the first full year is used, the estimated effect of cohort size in Model 2 of Table 1 for immigrant men remains unchanged. If the first three full years are used, the estimated effect changes slightly from -0.078 to -0.072.

affect immigrants' decision on whether to remain in Canada, move to other countries or return to their source country. Finally, more recent arrival cohorts only have limited observation points that can be reliably used to estimate their earnings growth profiles. The conventional approach to estimating earnings growth for newly arrived immigrants pools data from both more distant cohorts with many years of data, and more recent cohorts with few. This approach often leads to severely biased earnings trajectory for the more recent cohorts (Hou 2013a). For these reasons, the effect of cohort size on immigrant earnings growth is not examined in this study.

Annual earnings reflect the combined effect of annual hours worked (i.e., weeks worked and weekly full-time/part-time status), hourly wage rates, and the impact of bonuses and other supplementary earnings. The IMDB does not contain information on work times (weeks and hours worked). Consequently, it is not possible to separate wage rates and time worked. Annual earnings are adjusted to 2009 constant dollars; Statistics Canada's Consumer Price Index (CPI) is used to compute a measure of real earnings. To reduce the influence of outliers, real annual earnings are capped at $300,000. The natural logarithm of real annual earnings is used in all model estimates.

Ideally, one would also use the employment rate as an additional outcome variable. The IMDB does not have direct measures of labour force activity. Consequently, employment status can be derived only from the information on whether an individual had any non-zero employment earnings in a given year. However, as a result of changes in tax filing patterns, such derived measures are not comparable over time. [6]

3.2.2 Cohort size

The focal explanatory variable of this study is entry cohort size, or the annual level of immigration. Following the commonly-used procedure in the literature on the effect of birth cohort size, a five-year weighted moving average is used to define the cohort size for immigrants arriving in a given year (e.g.: Berger 1985; Brunello 2010; Welch 1979; Wright 1991). This moving average assumes that the earnings of a given immigrant cohort (year of landing) is affected by the size of its own cohort as well as by the size of the immediately preceding and immediately following cohorts. Immigrants who arrived in adjacent years are likely to be competing for similar jobs, because they face similar issues of language, credential recognition, and lack of Canadian experience in their job search. Weights are used to discount the size of the surrounding cohorts under the assumption that the degree of substitutability between immigrants across cohorts declines with years away from the landing year. As Wright (1991, p. 301) argues, these weights, although they may seem arbitrary, are "a logical first-choice" when no *a priori* information is available about the appropriate degree of substitutability.

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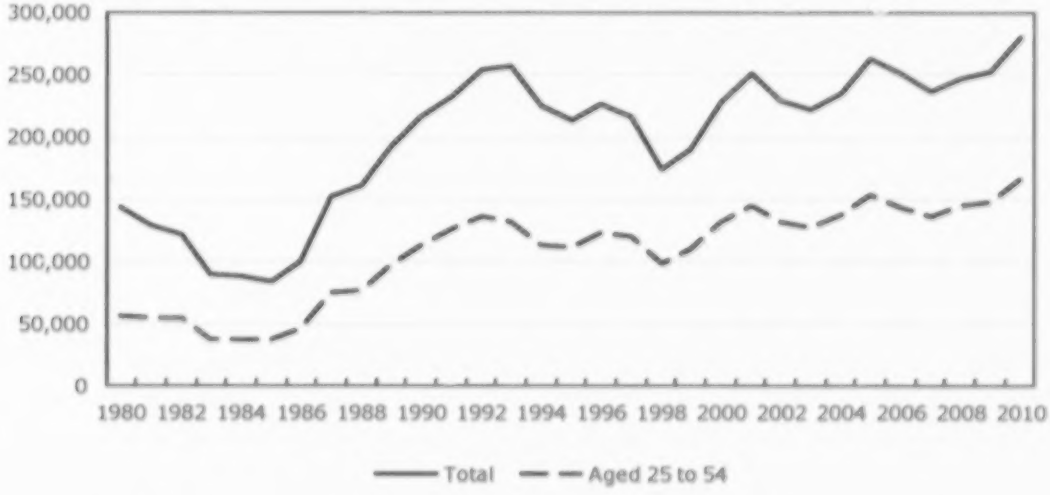
6. The introduction of the federal sales tax (FST) credit in 1986 and the goods and services tax (GST) credit in 1989 increased the incentive for low-income people to file tax returns. To gauge the impact of these changes on the historical compatibility, the study compares the trends in the population share with zero employment earnings from the Census and the Longitudinal Administrative Databank (LAD). The LAD and the IMDB both use the same tax records as the data source. The comparison of Census and LAD estimates of the population share with zero employment earnings among men aged 25 to 54 reveals significant changes in the tax-filing patterns in the LAD relative to the Census. The early 1990s changes in the tax rules resulted in an increase in the population share with zero earnings in the LAD (or IMDB). For example, in 1985, the estimated population share with zero earnings was 1.8 percentage points lower in the LAD than in the Census. However, in 1995 and 2000, the estimated shares in the LAD were 1.2 and 2.4 percentage points higher, respectively, than those in the Census. In 2005, when income information was retrieved from tax records for the majority of Census respondents, the estimated shares with zero earnings from the two data sources were the same. These comparisons suggest that the employment rate based on non-zero employment earnings from the LAD or the IMDB would overstate cross-cohort declines in employment rates.

In the current study, immigration cohort size is defined as $CS_{te} = (\frac{1}{9} * N_{(t-2)e} + \frac{2}{9} * N_{(t-1)e} + \frac{3}{9} * N_{te} + \frac{2}{9} * N_{(t+1)e} + \frac{1}{9} * N_{(t+2)e})$, where N_{te} denotes the number of prime-working-age immigrants (aged 25 to 54) with education level e who arrived in year t. $N_{(t-1)e}$ and $N_{(t-2)e}$ are the corresponding numbers of immigrants who arrived in year 1 before year t and in year 2 before year t, respectively, while $N_{(t+1)e}$ and $N_{(t+2)e}$ are the corresponding numbers in year 1 after year t and year 2 after year t, respectively. The study tested the sensitivity of the model results to alternative specifications of adjacent years and weights used to derive cohort size. These alternative specifications yield results that are not qualitatively different from those based on the chosen specification (see Subsection 4.3 on robustness tests).

Three education levels—university degree, some postsecondary education, and high school education or less—are used to disaggregate the annual level of immigration. That is, cohort size is defined jointly by year and education level. This is done for two critical reasons. First, it is reasonable to assume that immigrants with different levels of education engage in different segments of the labour market, as evident in large earnings differences by educational level among immigrants (Aydemir and Skuterud 2005; Bonikowska et al. 2010). Second, the trends in the annual level of immigration differ considerably by educational level. For immigrants as a whole, after a decrease over the 1983-to-1986 period, the annual inflows climbed to a peak in the 1992-to-1993 period, then declined to a lower point in 1998 before rising again in the 2000s (Chart 1).

Chart 1
Annual levels of immigration to Canada

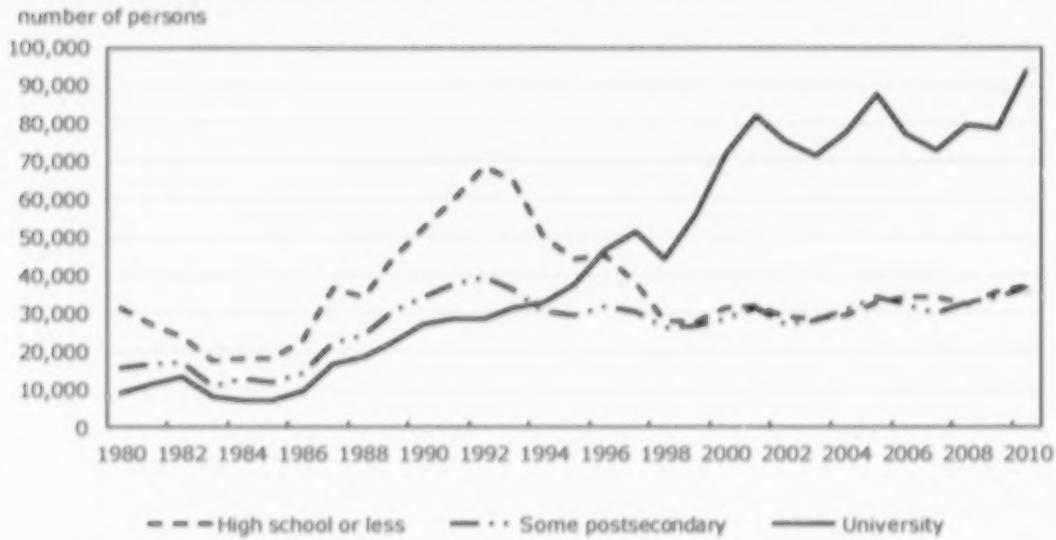
number of persons



Sources: Citizenship and Immigration Canada, *Facts and Figures 2010* and immigrant landing files.

Disaggregating the overall trend reveals distinct patterns across educational levels. The number of immigrants with high school education or less peaked in 1992 and declined steadily until the end of the 1990s before stabilizing (Chart 2).[7] A similar trend is observed among immigrants with some postsecondary education although this trend shows a lower peak in the early 1990s. In contrast, the number of immigrants with university degrees rose continuously through the 1990s, rising particularly fast during the information technology boom of the late 1990s, and then generally stabilizing at high levels in the 2000s (Chart 2).

Chart 2
Annual inflows of immigrants aged 25 to 54 by education level



Source: Citizenship and Immigration Canada, immigrant landing files.

These different trends by educational levels increase the variation of cohort size and are critical for separating the effect of cohort size from the general cohort effect.[8] There are, of course, other ways of defining cohorts. Alternative ways of defining cohort size (i.e., the annual level of immigration), and the effect of these alternatives on the results, are discussed in Subsection 4.3, "Robustness tests."

7. The increase in immigrants with high school education or less in the late 1980s and early 1990s coincided with two Citizenship and Immigration Canada policy changes. One is the "Backlog Clearance Program," which dealt with refugee claims made prior to, and unresolved at, the time when the *Refugee Reform Act* came into effect. The other involved the relaxation of the admission criteria for dependent children in the 1988-to-1992 period. To check whether the model estimates are strongly affected by this unique change, the study compared results with and without immigrants who were admitted as under the two policy changes. The estimated effect of cohort size for men increases slightly from -0.078 in the full sample to -0.082 in the sample without immigrants admitted under the two unique programs.
8. "Cohort effects" refers to differences across cohorts in the initial status and subsequent progression of a specific outcome (here, annual earnings) as the consequences of environmental factors and differences in population composition. For cohorts of entering immigrants in particular, cohort effects on labour market outcomes can arise from differences in observed demographic composition, unobserved immigrant characteristics, cohort size, and absorptive capacity of the Canadian economy (i.e., economic conditions and labour demand/supply). In the models, the study separates the overall cohort effect into several contributing components: the independent effects of cohort size, changes in immigrants' demographic composition, macroeconomic conditions, and residual cohort effects (see discussion in Sub-subsection 3.2.4).

3.2.3 Other aggregate variables used to control for macroeconomic conditions

The multivariate models also include three aggregate variables to control for the effect of macroeconomic conditions on the trends in immigrant earnings. These variables are intended to capture the period effect that may potentially be confounded with the effect of cohort size.

The first measure is the unemployment rate of prime-working-age (25 to 54) males at the year of landing in Canada.[9] This unemployment rate is commonly used to reflect the macroeconomic conditions for immigrants at landing (e.g., Aydemir 2003; Chiswick et al. 1997).[10] This variable is included to control for the effect of economic conditions at landing on immigrant earnings.[11] The entry-year unemployment rates are measured at the regional level (Toronto, Montreal, Vancouver, and provinces) based on immigrants' intended destinations.

The second measure is the current-year unemployment rates for prime-working-age (25 to 54) males. This variable controls for the effect of changes in economic conditions on immigrant earnings profiles in years after landing in Canada. The current-year unemployment rates are measured at the regional level (Toronto, Montreal, Vancouver, and provinces) and are based on immigrants' geographic location of residence in a given income year.

While annual unemployment rates for prime-working-age workers reflect fluctuations in general economic conditions related to business cycles, a different measure is used to reflect long-term changes relevant to new labour entrants. As shown in Chart 3, the real earnings of young men (those aged 20 to 34) declined from the early 1980s to the mid-1990s and then recovered somewhat (Beaudry and Green 2000; Morissette 2008). Since recent immigrants are also new entrants to the Canadian labour market, they would also be similarly affected (Green and Worswick 2010). This study uses the weekly paid-employment earnings of Canadian-born full-year full-time male workers aged 20 to 34 to control for factors that influence the earnings of new labour entrants. These earnings are derived from the 1980-to-1995 Survey of Consumer Finance (SCF) and the 1996-to-2010 Survey of Labour and Income Dynamics (SLID).[12] Weekly earnings trends are estimated for six regions, adjusted for single year of age and two categories of education (with or without university degrees).[13] The estimated earnings are in 2009 constant dollars. This variable is merged to individual immigrants based on the income year and region of residence.

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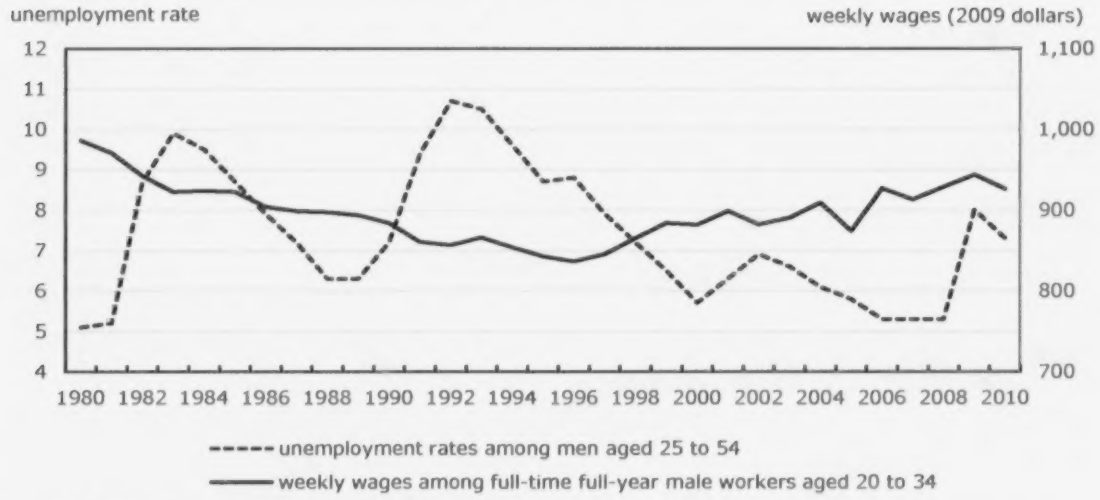
9. The unemployment data are downloaded from CANSIM table 282-0211, which is based on Labour Force Survey estimates.
10. Using unemployment rates for younger age groups, which might better reflect economic conditions for labour market entrants, yields similar results because the trends in the unemployment rates for different age groups are highly correlated. For instance, over the period of this study, the unemployment rates at the national level for age 25 to 29 and for age 25 to 54 followed an almost identical trend (Pearson $r = 0.97$).
11. Alternatively, employment rates could also be used to capture the macroeconomic conditions at year of landing. The two measures are highly correlated, and both yield very similar results. For the period covered in this study, the Pearson r between the unemployment rate and the employment rate is 0.92. When each measure is included in the model separately, the coefficients are similar in magnitude. The unemployment rate is negatively associated with immigrant earnings, while the employment rate is positively associated with immigrant earnings. When both are entered in the same model, the employment rate coefficients are not significant.
12. The SCF was discontinued after 1997, while the SLID was initiated in 1993. Thus, both the SCF and the SLID collected data for the years from 1993 to 1997. The observed male weekly earnings for the selected sample from the two sources differ by 1.1% to 1.6% in 1994 and 1995, and by 1.9% to 2.7% in 1993, 1996, and 1997. The weekly earnings estimates from the two sources are broadly consistent in the overlapping years. For this study, 1996 was chosen as the point to switch from the SCF to the SLID because the sample size for the selected group doubled from 1600 in 1995 to 3230 in 1996 in the SLID.
13. Canadian-born full-time full-year male paid workers in each SCF and SLID year are pooled to estimate average weekly earnings at the regional level, adjusting for differences in age and education over time and across regions. The yearly sample size for the selected group ranges from 1900 to 5900 in the SCF and from 2000 to 3400 in the SLID. Because the yearly sample size is not very large, provinces are combined into six regions: Atlantic Region; Quebec; Ontario; Manitoba and Saskatchewan; Alberta; and British Columbia. In adjusting for education, only one dummy variable—"with university degree" versus "with lower levels of education"—is used because detailed categories are not compatible over time as a result of changes to educational classifications in the surveys.

Chart 3
Annual unemployment rates and wages of young male workers



Note: Weekly wages are adjusted for age and education.
Sources: Statistics Canada, CANSIM table 282-0211 (for unemployment rates), 1980-to-1995 Survey of Consumer Finance and 1996-to-2009 Survey of Labour and Income Dynamics (for adjusted weekly wages).

3.2.4 Residual cohort effects

The landing year is a key cohort-level variable that must be controlled for. It is well-known that labour market outcomes deteriorated for successive cohorts of entering immigrants over the last quarter-century, partly as a result of changes in immigrant characteristics and a general "new labour market entrant" effect (Frenette and Morissette 2005; Green and Worswick 2010; Reitz 2007). When controls are applied for the "new labour market entrant" effect, macroeconomic conditions, and immigrant characteristics, any remaining cohort effects would relate to unobserved factors such as changes to the transferability of foreign skills or changes in the Canadian labour market, which may have resulted in the Canadian labour market becoming less accommodating of foreign education and foreign work experience. These residual cohort effects may also be correlated with cohort size because the annual immigration level has been on the rise over the last quarter-century while the labour market outcomes of recent immigrants have been in decline. To separate the cohort size effect from the residual cohort effects, some assumptions about the residual cohort effects are necessary.

The residual cohort effects are assumed to be uniform among all immigrants arriving in a five-year period. This allows the cohort size effect to be identified through the variation in annual levels of immigration within the five-year periods observed. Following a conventional approach, we code landing years (cohorts) into six five-year periods: 1980–1984, 1985–1989, 1990–1994, 1995–1999, 2000–2004, and 2005–2009. Five dummies are created accordingly, with 1995–1999 as the reference period. The cohort dummy variables control for differences among five-year cohorts.

Alternatively, one can assume that the residual cohort effects change from one year to the next incrementally, reflecting the possibility that changes in the transferability of foreign skills or the absorptive capacity of the Canadian labour market take place gradually. Accordingly, landing years (cohorts) are coded as a continuous trend, i.e., an interval scale treating 1980 as 0 and 2009 as 29, or quadratic or cubic forms of the interval scale. Test results show that the

estimated cohort size effect is slightly smaller when the residual cohort effects are treated as a linear trend than when the residual cohort effects are based on five-year intervals. When the residual cohort effects are assumed to be the quadratic or cubic form of the linear trend, the estimated cohort size effect is also slightly smaller than that based on five-year intervals (the approach used in the reported results). If no residual cohort effects are assumed in the belief that the controls for macroeconomic conditions, the new labour market entrant effect, and changes in immigrant characteristics adequately account for differences in cohorts over time (i.e., no cohort effect variable is employed in the model), the estimated cohort size effect is about twice as large as when the cohort effect is specified as six five-year periods.[14] These results suggest that the chosen specification for the cohort effect—using the six five-year cohort dummies—yields a cohort size effect that is very similar to the alternatives tested, and conservative compared to the result when the "residual cohort" effect is excluded.

3.2.5 Individual-level control variables

The multivariate models also include the following demographic variables for each observation:

(1) Years of potential foreign labour market experience. This variable is derived as (age at landing minus years of schooling minus 6).

(2) Marital status in each tax year grouped into three categories: single; separated, divorced, or widowed; married or living common-law.

(3) Self-reported ability to speak an official language at landing: it is coded as four categories: English; French; both English and French; neither English nor French. The reference group is "English."

(4) Immigrant class. This variable is coded as six categories: family; business; skilled class principal applicants; skilled class spouses and dependents; refugees; and other immigrants (backlog, live-in-caregivers, and others). The reference is "skilled class principal applicants."

(5) Education at landing. This variable is grouped into five categories: less than grade 11; grade 11 or grade 12; some postsecondary; bachelor's degree; and master's or doctorate degree. The reference group is "bachelor's degree."

(6) Immigrant source regions. This variable is grouped into 10 categories: the United States; the Caribbean, Central America, and South America; Northern and Western Europe; Southern and Eastern Europe; Africa; South Asia; East Asia; Southeast Asia; other Asian countries; and other countries. The United States is used as the reference.

(7) Geographic location of residence in each tax year. This variable is grouped into 14 categories: Montreal; Toronto; Vancouver; the 10 provinces individually (excluding the three aforementioned cities in their respective provinces); and the territories combined (Yukon, Northwest Territories, and Nunavut). Toronto is used as the reference group.

14. As in Model 2, Table 1, the estimated cohort size effect is -0.078 when residual cohort effects are specified as constant within a five-year period. When the residual cohort effects are represented as a linear trend, the estimated cohort size effect is -0.068. When the quadratic trend and cubic trend of the residual cohort effect are specified, the estimated cohort size effect is -0.069 and -0.071, respectively. If no residual cohort effect is specified, the estimated cohort size effect is -0.135.

3.3 Methods

The following three regression models are estimated for men and women separately:

$$(1)\,\text{Log earnings} = \beta_{cs} * \log(CS) + \Sigma\beta X + e$$

$$(2)\,\text{Log earnings} = \beta_{cs} * \log(CS) + \Sigma\beta X + \beta_{ue} * U_{ent} + \beta_{uc} * U_{cur} + \beta_{w} * W + e$$

$$(3)\,\text{Log earnings} = \beta_{cs} * \log(CS) + \Sigma\beta X + \beta_{ue} * U_{ent} + \beta_{uc} * U_{cur} + \beta_{w} * W + \gamma * \log(CS) * U_{ent} + e$$

The first model tests whether there is a significant cohort size—$\log(CS)$—effect when immigrants' individual characteristics (X) are controlled for. Since logarithmic transformations are used for both earnings and cohort size, the coefficient β_{cs} for $\log(CS)$ is interpreted as elasticity. For instance, a coefficient of -0.10 can be interpreted as a 10% increase in cohort size associated with a 1% decrease in immigrant earnings.

The second model tests whether any cohort size effect remains after further controlling for entry-year unemployment rates (U_{ent}), current-year unemployment rates (U_{cur}), and weekly earnings of Canadian-born young male workers (W). The third model includes the interaction term between cohort size and entry-year unemployment rates. This interaction term tests whether the effect of cohort size varies with economic conditions at entry, for example, whether the effect is stronger during periods of economic downturn.

Given the multilevel nature of the data, cluster-robust standard errors are estimated in order to correct within-cluster correlation (Angrist and Pischke 2009; Wooldridge 2003). Clustering of observations associated with group-level variables will generally underestimate standard errors of the coefficients and must be corrected, but will not affect the magnitude of the coefficients. The clustering of observations by year of landing and education (i.e., $30 \times 3=90$ clusters) is used to correct for the clustering effect. This is the clustering associated with the cohort size variable, our focal independent variable.[15]

15. The aggregate variables in this study have different types of multi-level clustering. The cohort size measure is clustered by the combination of year of landing and education. The entry-year unemployment rates are clustered by year of landing and by intended landing province and major metropolitan area. The current-year unemployment rates are clustered by year of income observed and by province or major metropolitan area of residence in the year of filing tax. The weekly earnings of Canadian-born young men are clustered by year of income and geographic region. These inconsistent units of clustering across different variables lack a nesting hierarchical structure and thus preclude the use of conventional Hierarchical Linear Modeling strategies to take into account each and every level of clustering in a unified model. Instead, linear regression models with cluster-robust standard errors are estimated in order to correct within-cluster correlation. To test robustness of the results, alternative clustering units are experimented with, including individual immigrants (to correct for serial correlation), year-of-landing by landing location (for the entry-year unemployment rates), income year by current location of residence (for current-year unemployment rates), and year-of-landing by education (for cohort size). Generally speaking, the estimated standard errors increase as the aggregate level of clustering increases. The smallest standard errors are produced when individual immigrants are used as the unit of clustering, and the largest standard errors are produced when the unit is year-of-landing by education. The results using year-of-landing by education as the unit of clustering are presented because the significance of the coefficient of cohort size variable is the focus of the analysis and the estimated standards are the most conservative. For instance, the standard error associated with log cohort size increased from 0.0018 without considering any clustering, to 0.0022 when individual immigrants are used as the unit of clustering, to 0.0086 when the unit is the combination of year-of-landing and intended landing locations, and further to 0.0132 when the unit is the combination of year-of-landing and education.

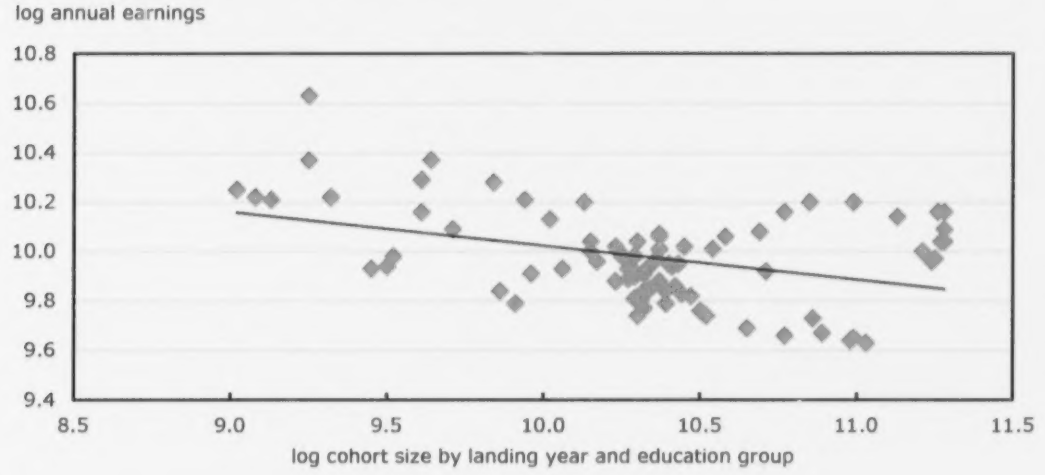
Rather than using a "correction for clustering" approach to estimating the standard errors, one could use a two-step approach (Angrist and Pischke 2009). This approach first estimates average outcomes at the group level, controlling for group differences in individual-level characteristics, and then runs grouped-data models in the second step. In unreported runs, the study compared the results based on the clustering approach and the two-step approach. When all group-level variables are based on the same grouping (e.g., landing year by educational level), the two approaches yield almost identical coefficients on the cohort size variable. The main difference is that the latter approach produces more conservative standard errors—about 10% larger in the data employed in this study. Given that our cohort size coefficient is tightly estimated, the difference in the standard errors does not change our conclusions. As Angrist and Pischke (2009) have suggested, the two-step approach is preferable when the number of groups is small (about 40 or less). This study includes 90 groups; therefore, doing the two-step does not make a large difference. Furthermore, the data employed in this study are more complicated because the three aggregate-level economic control variables are based on groupings (either by year and province or by year and region) different from the grouping for the cohort size variable. This makes it difficult to find a uniform grouping for the two-step approach. Hence, the study estimates the model at the micro-level and corrects for clustering.

4 Results

4.1 Entry earnings among immigrant men

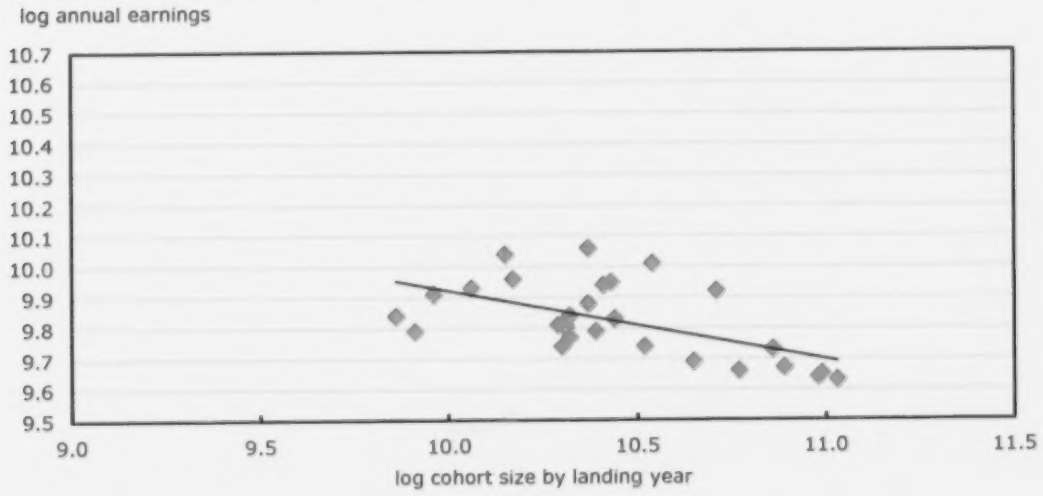
In the raw data, without controls for individual-level characteristics and macroeconomic conditions, there is a negative correlation between average entry earnings and cohort size for immigrant men as a whole and within each broad educational level. This is seen in Charts 4 to 7, which plot the log average earnings of male immigrants in their first two full years in Canada against log cohort size by year of landing and education as defined in Subsection 3.2. No obvious outliers are observed.

Chart 4
Cohort size and observed log earnings in the first two full years in Canada, male immigrants aged 25 to 54



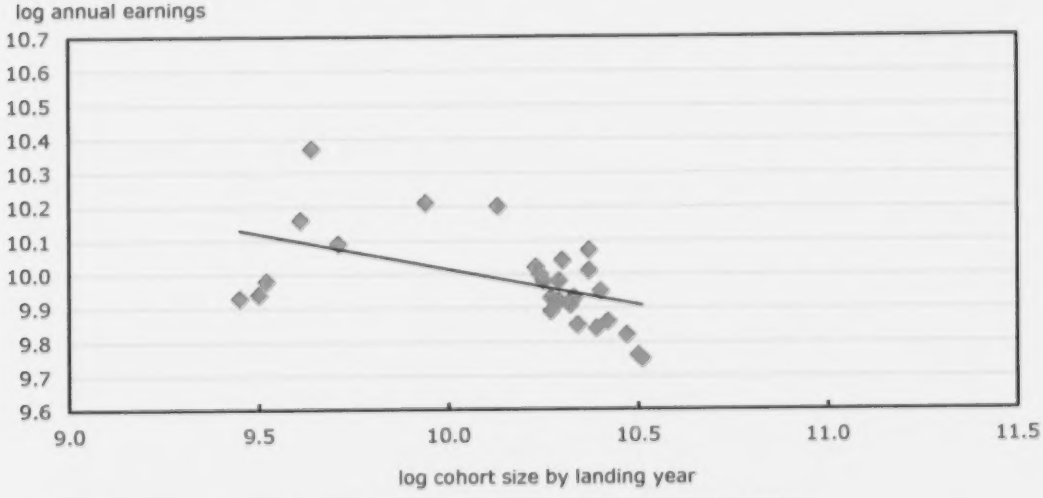
Source: Statistics Canada, Longitudinal Immigration Database, 1982 to 2009.

Chart 5
Cohort size and observed log earnings in the first two full years in Canada, male immigrants aged 25 to 64 — High school or less



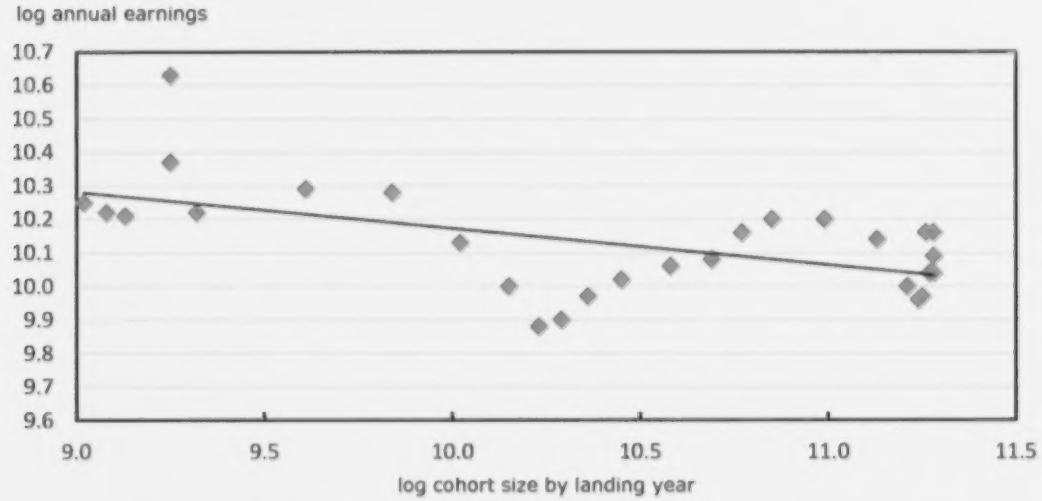
Source: Statistics Canada, Longitudinal Immigration Database, 1982 to 2009.

Chart 6
Cohort size and observed log earnings in the first two full years in Canada, male immigrants aged 25 to 64 — Some postsecondary



Source: Statistics Canada, Longitudinal Immigration Database, 1982 to 2009.

Chart 7
Cohort size and observed log earnings in the first two full years in Canada, male immigrants aged 25 to 64 — University degree



Source: Statistics Canada, Longitudinal Immigration Database, 1982 to 2009.

Multivariate models allow us to ask whether the observed association remains significant once residual cohort effects, changes in immigrant characteristics, and macroeconomic conditions are controlled for. These models will also allow us to ask whether the effect of cohort size varies with the macroeconomic conditions at time of landing.

Table 1 presents results of the three regression models for immigrant men. Model 1 includes log cohort size as well as cohort dummies and other immigrant characteristics. The coefficient on the log cohort size variable is statistically significant. Its value of -0.086 implies that a 10% increase in cohort size as defined earlier is associated with a decline of about 0.86% in the annual entry earnings of immigrants in that cohort. In Model 2, where entry-year unemployment rates, current-year unemployment rates, and the weekly wages of Canadian-born young male workers are controlled for, the magnitude of the log cohort size coefficient decreases slightly, to -0.078. This small change implies that the effect of cohort size is mostly independent of the effect of the three aggregate economic variables.

Table 1
Regression models predicting entry earnings of immigrant men aged 25 to 64

	Model 1		Model 2		Model 3	
	coefficient	robust standard error	coefficient	robust standard error	coefficient	robust standard error
Log cohort size	-0.086***	0.019	-0.078***	0.013	-0.114***	0.028
1980-to-1984 cohort	0.049	0.036	0.073**	0.027	0.074**	0.027
1985-to-1989 cohort	0.106***	0.029	0.061***	0.016	0.062***	0.015
1990-to-1994 cohort	-0.104***	0.023	0.065***	0.014	0.061***	0.013
2000-to-2004 cohort	-0.027	0.028	-0.084***	0.015	-0.082***	0.015
2005-to-2009 cohort	0.043	0.027	-0.063***	0.012	-0.060***	0.013
Years of foreign experience	-0.003***	0.001	-0.003***	0.001	-0.003***	0.001
Less than high school	-0.066***	0.015	-0.067***	0.009	-0.071***	0.009
High school graduation	-0.080***	0.018	-0.078***	0.011	-0.080***	0.011
Some postsecondary	-0.092***	0.017	-0.089***	0.011	-0.091***	0.010
Graduate degree	0.016*	0.008	0.021**	0.007	0.021**	0.007
French	-0.197***	0.009	-0.182***	0.009	-0.182***	0.009
Both English and French	-0.078***	0.008	-0.062***	0.007	-0.063***	0.007
Neither English nor French	-0.098***	0.008	-0.096***	0.008	-0.096***	0.008
Family class	-0.312***	0.009	-0.297***	0.008	-0.297***	0.008
Business class	-0.354***	0.018	-0.331***	0.016	-0.331***	0.016
Spouse or dependant of skilled worker	-0.252***	0.009	-0.245***	0.008	-0.245***	0.008
Refugee	-0.396***	0.008	-0.383***	0.008	-0.383***	0.008
Other class	-0.191***	0.021	-0.219***	0.017	-0.217***	0.017
Single	-0.177***	0.012	-0.171***	0.013	-0.172***	0.013
Separated, divorced, or widowed	-0.166***	0.010	-0.171***	0.010	-0.170***	0.010
Northern and Western Europe	0.014	0.018	0.002	0.017	0.001	0.017
Southern and Eastern Europe	-0.428***	0.031	-0.438***	0.030	-0.438***	0.030
Africa	-0.536***	0.031	-0.550***	0.030	-0.551***	0.030
East Asia	-0.780***	0.037	-0.791***	0.036	-0.791***	0.036
South Asia	-0.638***	0.033	-0.643***	0.033	-0.643***	0.033
Southeast Asia	-0.501***	0.028	-0.508***	0.027	-0.508***	0.027
West Asia/Middle East	-0.746***	0.032	-0.754***	0.032	-0.754***	0.032
Caribbean, Central America, and South America	-0.504***	0.026	-0.514***	0.025	-0.514***	0.025
Other countries	-0.236***	0.025	-0.238***	0.024	-0.238***	0.024
Entry year unemployment rates	...	...	-0.029***	0.002	-0.087*	0.037
Current year unemployment rates	...	...	-0.028***	0.003	-0.028***	0.003
Log wages of young Canadian-born men	...	...	0.881***	0.083	0.901***	0.083
Log cohort size interacted with entry year unemployment rates	...	...	...	...	0.006	0.004

... not applicable

*** significantly different from reference category ($p<0.001$)

** significantly different from reference category ($p<0.01$)

* significantly different from reference category ($p<0.05$)

Note: The geographic location fixed effects are included in all three models. R-squared of Model 1: 0.161; R-squared of Models 2 and 3: 0.171.

Source: Statistics Canada, Longitudinal Immigration Database, 1982 to 2009.

The estimated effect of cohort size is not large; however, it should be interpreted within the context of fairly large changes in immigration levels over the study period. Since the average size of entry cohorts of working-age immigrants rose from 47,800 to 145,400 (or an increase of 1.11 log points) from the 1980-to-1984 cohort to the 2005-to-2009 cohort (see Chart 1), changes in cohort size could be associated with a large decline in entry earnings between immigrants who entered in the 1980s and those entering in the late 2000s. This effect of changes in cohort size on earnings differences across landing cohorts is illustrated by comparing results from models with and without cohort size. When cohort size is included, as in Model 2, the entry earnings of the 1980-to-1984 landing cohort are about 7.3% higher than those of the reference group—the 1995-to-1999 cohort. When cohort size is not included (model not presented), the 1980-to-1984 cohort has earnings about 14.6% higher than those of the 1995-to-1999 cohort. These results suggest that the difference in cohort size is associated with about 7.3% decline in entry earnings from the 1980-to-1984 cohort to the 1995-to-1999 cohort. Similarly, the increase in cohort size accounts for 3.5% decline in entry earnings from the 1985-to-1989 cohort to the 1995-to-1999 cohort, and 2.0% decline in entry earnings from the 1995-to-1999 cohort to the 2005-to-2009 cohort. From the 1980-to-1984 cohort to the 2005-to-2009 cohort, entry earnings among immigrant men decline 22.9% when changes in immigrant characteristics and macro-economic conditions are taken into account (model not presented). This gap narrows to 13.6% when the change in cohort size is further controlled for (Model 2 Table 1). Hence, changes in cohort size are associated with a 9.3% decline in entry earnings between immigrants in the 1980-to-1984 cohort and the 2005-to-2009 cohort.

Both entry-year unemployment rates and current-year unemployment rates are negatively associated with immigrant entry earnings. The coefficient on the entry-year unemployment rate variable implies that a 1-percentage-point increase in the unemployment rate in the year of landing is associated with a 2.9-percentage-point decline in the earnings of immigrants arriving that year. Assuming the unemployment rate increased by 4 percentage points from peak to trough in a recession, such a recession would tend to decrease immigrant entry earnings by 11.6%.[16] The large coefficient associated with the log weekly wages of Canadian-born young men suggests that immigrants follow closely the earnings trends among Canadian-born new labour market entrants. A 10% increase in earnings among Canadian-born young men is associated with an 8.8% increase in immigrant entry earnings (Table 1).

The interaction term between cohort size and entry-year unemployment rates is not statistically significant. This suggests the effect of cohort size does not vary with macroeconomic conditions at time of entry.

The effects of other demographic variables on immigrant earnings are generally consistent with the findings of previous studies. There is no positive earnings return to foreign work experience. Higher educational levels and speaking English are associated with higher earnings. There are large earnings differences among different immigrant classes. Regarding source region, immigrant men from East Asia, West Asia/the Middle East, and South Asia, have the lowest earnings, followed by those from Africa, South-east Asia, and the Caribbean, Central America, and South America.

16. In the recessions of the early 1980s, the early 1990s, and the late 2000s, the national unemployment rate of men aged 25 to 54 increased by 4.7, 4.4, and 2.7 percentage points from peak to trough in each of these cycles, respectively.

4.2 Entry earnings among immigrant women

Among women, the size of a specific cohort is negatively but not significantly associated with the entry earnings of those in the same cohort (Model 1, Table 2). This small effect likely reflects the fact the immigrant women have a lower labour force participation rate than immigrant men, and thus they may not face the same degree of competition with other immigrants who arrive in the same year.[17] It is also possible that, after landing, immigrant women may be more likely than immigrant men to postpone entry into the Canadian labour market and thus may be less affected than immigrant men by the labour supply of their own cohort.[18]

The inclusion of the three aggregate economic variables makes the coefficient of log cohort size statistically significant (Model 2, Table 2). As with men, entry-year unemployment rates are negatively associated with earnings among immigrant women. The current-year unemployment rates are also significantly associated with immigrant women's earnings, although the effect is much smaller than that on immigrant men. Furthermore, immigrant women's earnings are strongly associated with the log weekly earnings of Canadian-born young men; this suggests that macro economic conditions affecting the wages of new labour market entrants in general also affect the wages of entering female immigrants.

Similar to the results among immigrant men, the interaction term between cohort size and entry-year unemployment rates is not statistically significant.

The effects of individual-level demographic factors on immigrant women's entry earnings are generally in the same direction as they are for men, although the magnitudes may be different. Earnings returns to higher education are much larger among immigrant women than among immigrant men. This is a general observation that holds for the Canadian-born population as well. In contrast, the earnings differences by source region are much smaller among immigrant women than among immigrant men. Interestingly, marital status makes little difference to earnings among immigrant women. If anything, married immigrant women earn less than single ones. Married immigrant men, however, earn 17% more than immigrant men who are separated, divorced, or widowed, and 17% more than single immigrant men.[19]

17. Estimates from the Census and the Labour Force Survey show that, in the 1990s and the 2000s, the labour force participation rate among immigrant women who had been in Canada for five years or less was 20 percentage points lower than that among their male counterparts.
18. For instance, the labour force participation rate of recent immigrant women arriving in the late 1990s was 65% from their 1st year to their 5th year after landing and increased to 74% in the 11th to 15th years. By comparison, among recent immigrant men, the rate started higher, at 86%, but had increased by only 4 more percentage points after 10 years.
19. One possible explanation is that married immigrant men work more than single immigrant men or separated, divorced, or widowed immigrant men because they have families to support. It is worth noting that the outcome variable is annual earnings, which are jointly determined by hours worked and wage rates. Using the combined 2006-to-2012 May and November Labour Force Survey, a model with log hourly wages as the outcome, with controls for full-time status and other socio-demographic variables, is also estimated. The results show that the wage rate of married immigrant men is only 4% higher than that for separated, divorced, or widowed immigrant men, and 5% higher than that for single immigrant men. These differences are much smaller than those based on annual earnings. For immigrant women, hourly wages also show very small gaps by marital status.

Table 2
Regression models predicting entry earnings of immigrant women aged 25 to 64

	Model 1		Model 2		Model 3	
	coefficient	robust standard error	coefficient	robust standard error	coefficient	robust standard error
Log cohort size	-0.027	0.015	-0.027*	0.010	-0.050*	0.022
1980-to-1984 cohort	0.050	0.030	0.043*	0.020	0.044*	0.020
1985-to-1989 cohort	0.109***	0.021	0.070***	0.014	0.070***	0.014
1990-to-1994 cohort	-0.031	0.016	0.062***	0.011	0.060***	0.010
2000-to-2004 cohort	-0.019	0.018	-0.059***	0.010	-0.058***	0.010
2005-to-2009 cohort	0.032	0.017	-0.047***	0.008	-0.045***	0.009
Years of foreign experience	-0.001***	0.000	-0.001***	0.000	-0.001***	0.000
Less than high school	-0.138***	0.012	-0.137***	0.008	-0.140***	0.008
High school graduation	-0.128***	0.017	-0.127***	0.013	-0.128***	0.012
Some postsecondary	-0.105***	0.014	-0.104***	0.009	-0.105***	0.009
Graduate degree	0.078***	0.005	0.080***	0.005	0.080***	0.005
French	-0.129***	0.008	-0.118***	0.008	-0.117***	0.008
Both English and French	0.042***	0.007	0.054***	0.007	0.053***	0.007
Neither English nor French	-0.113***	0.009	-0.110***	0.009	-0.110***	0.009
Family class	-0.260***	0.010	-0.254***	0.010	-0.254***	0.010
Business class	-0.316***	0.012	-0.301***	0.012	-0.301***	0.012
Spouse or dependant of skilled worker	-0.206***	0.011	-0.209***	0.011	-0.209***	0.011
Refugee	-0.307***	0.012	-0.303***	0.011	-0.303***	0.011
Other class	-0.175***	0.018	-0.197***	0.017	-0.197***	0.017
Single	0.051***	0.010	0.057***	0.011	0.057***	0.011
Separated, divorced, or widowed	0.018*	0.007	0.015	0.007	0.015	0.007
Northern and Western Europe	-0.138***	0.017	-0.145***	0.017	-0.145***	0.017
Southern and Eastern Europe	-0.411***	0.025	-0.417***	0.025	-0.417***	0.025
Africa	-0.394***	0.025	-0.402***	0.024	-0.403***	0.024
East Asia	-0.483***	0.036	-0.490***	0.036	-0.490***	0.036
South Asia	-0.559***	0.028	-0.560***	0.029	-0.560***	0.029
Southeast Asia	-0.405***	0.024	-0.409***	0.024	-0.409***	0.024
West Asia/Middle East	-0.595***	0.027	-0.601***	0.027	-0.601***	0.027
Caribbean, Central America, and South America	-0.412***	0.021	-0.418***	0.021	-0.418***	0.021
Other countries	-0.144***	0.022	-0.141***	0.021	-0.141***	0.021
Entry year unemployment rates	...	...	-0.025***	0.002	-0.063*	0.030
Current year unemployment rates	...	...	-0.009**	0.003	-0.009**	0.003
Log wages of young Canadian-born men	...	...	0.606***	0.076	0.618***	0.077
Log cohort size interacted with entry year unemployment rates	...	...	...	...	0.004	0.003

... not applicable

*** significantly different from reference category ($p<0.001$)

** significantly different from reference category ($p<0.01$)

* significantly different from reference category ($p<0.05$)

Note: The geographic location fixed effects are included in all three models. R-squared of Model 1: 0.108; R-squared of Models 2 and 3: 0.113.

Source: Statistics Canada, Longitudinal Immigration Database, 1982 to 2009.

4.3 Robustness tests

A number of robustness tests were presented earlier in the text. First, the study used a two-step regression approach that produces more reliable standard errors than clustered estimation. Second, it used a quadratic or cubic functional form, rather than a constant effect over a five-year interval, to estimate the residual cohort effect. These alternative approaches produced results regarding the cohort size effect very similar to those reported in the previous section.

The study also tested the sensitivity of the model estimates to two types of alternative specifications of cohort size. The first type relates to the assumptions of substitutability among immigrants arriving in adjacent years. Model 2 is estimated in Table 1 for immigrant men, replacing the cohort size measure with the following alternative measures:

(1) $CS_{te} = N_{te}$

(2) $CS_{te} = (\frac{1}{3} * N_{(t-1)e} + \frac{2}{3} * N_{te})$

(3) $CS_{te} = (\frac{1}{6} * N_{(t-2)e} + \frac{1}{3} * N_{(t-1)e} + \frac{1}{2} * N_{te})$

(4) $CS_{te} = (\frac{1}{4} * N_{(t-1)e} + \frac{1}{2} * N_{te} + \frac{1}{4} * N_{(t+1)e})$

(5) $CS_{te} = (\frac{1}{3} * N_{(t-1)e} + \frac{1}{2} * N_{te} + \frac{1}{6} * N_{(t+1)e})$

The first specification assumes no substitution among immigrants who arrive in surrounding years. The other alternative specifications assume varying degrees of substitution with immigrants arriving in other years: the second specification assumes some substitution with the preceding year; the third with the preceding two years; the fourth with both the preceding year and the following year; and the fifth with both the preceding year and the following year, but giving more weight to the preceding years.

The results of these alternative specifications are presented in the left panel of Table 3. The result of the study's original specification (cohort size as weighted five-year moving average) is presented at the bottom of the table. There are three major observations from these results. First, allowing some degree of substitution among immigrants arriving in the adjacent years leads to a larger estimated effect of cohort size. Second, the estimated effect of cohort size increases as the number of surrounding years used in the cohort definition increases from two to three, and to five. Third, the results from the three alternative sets of weights used to calculate the three-year moving average (i.e., alternative measures 3, 4, and 5) are very similar. This suggests that the choice of weights, although arbitrary, does not substantially change the estimated effect of cohort size.

Table 3

Robustness tests of the effects of alternative cohort size measures on entry earnings of immigrant men

	Cohort size disaggregated by education		Cohort size disaggregated by education and age group	
	coefficient	robust standard error	coefficient	robust standard error
Specification 1: Current year cohort size	-0.063***	0.013	-0.044***	0.009
Specification 2: Two-year moving average of current year and preceding year	-0.070***	0.013	-0.048***	0.009
Specification 3: Three-year moving average of current year and preceding two years	-0.076***	0.013	-0.052***	0.009
Specification 4: Three-year moving average of current year and surrounding two years	-0.071***	0.013	-0.048***	0.009
Specification 5: Three-year moving average of current year and surrounding two years, favouring the preceding year	-0.072***	0.013	-0.049***	0.009
Specification 6: Five-year moving average	-0.078***	0.013	-0.051***	0.009

*** significantly different from reference category (p<0.001)

Note: All models also include control variables in Model 2 of Table 1.

Source: Statistics Canada, Longitudinal Immigration Database, 1982 to 2009.

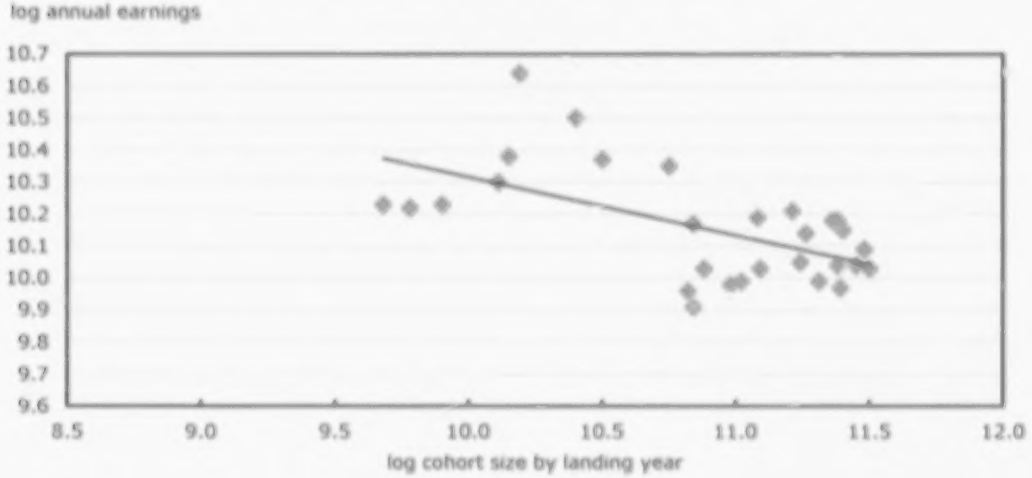
An additional robustness check involved the definition of *cohort*.[20] In the results presented earlier, the cohorts were defined on the basis of landing year and educational level. But one could make an argument that the age group should also be considered in defining cohorts. It may be that younger entering immigrants do not seek the same types of jobs as older, more experienced, entering immigrants. The estimates based on disaggregation by educational level, age group, and landing year are presented in the right panel of Table 3.[21] These estimated effects of cohort size are smaller than those based on disaggregation by education and landing year only. These results suggest that it is too restrictive to assume that older and younger immigrants arriving in the same year and with the same educational level do not compete in the same segment of the labour market. Among the domestic-born, younger and older workers are not perfect substitutes and may not compete directly in the labour market. However, among immigrants, previous studies show that earnings returns to foreign work experience have declined to virtually zero since the 1990s (Green and Worswick 2010; Hou 2013b; Schaafsma and Sweetman 2001). This implies that immigrants with the same level of education but arriving at different ages (i.e., years of work experience before coming to Canada) compete with one another for the same types of jobs, often entry-level jobs, in the labour market.

20. In addition to the various definitions of cohorts for which robustness tests were produced, one might consider defining a cohort at a smaller geographic area, such as city/province, rather than at the national level. Such an approach presents a number of problems, and hence was not attempted. First, within the first year after landing, a significant proportion (about 20%) of immigrants do not actually reside in their "intended" destination, thus introducing error into estimates produced at the regional level. Second, immigrant mobility remains high in the first few years following landing. Hence, the observed wages for many immigrants reflect conditions in their newly selected community rather than cohort size or other aspects of their originally intended or initially selected area. Finally, there is little regional variation in cohort size trends. Until very recently, the shares of immigrants going to the major locations (i.e., Toronto, Montreal and Vancouver census metropolitan areas) have been quite stable. Hence, disaggregating cohort size by major city or province does little to increase the variation in cohort size beyond the national trends.

21. Four age groups are specified in the disaggregation: 25 to 29; 30 to 34; 35 to 44; and 45 to 54.

A third alternative definition of cohort size relates to immigrant class. Immigrants in different admission categories may seek different types of jobs and display different labour market behaviours. For example, family class immigrants may not seek the types of professional jobs sought by economic class immigrants. At the bivariate level, significant correlations are found between cohort size by immigrant class and earnings (Charts 8 to 10). Models base 1 on the disaggregation of four broad admission categories (economic immigrants, family, refugees, and others) controlling for changes in immigrant demographic composition but without the inclusion of residual cohort effects show that a 10% increase in cohort size is associated with 1.1% decrease in male immigrant entry earnings. However, this effect becomes close to 0 once controls for residual cohort effect are applied. [22] This is likely because there is not a large enough variation in time trends among immigrant categories to make it possible to separate the cohort size effect from the general cohort effect.[23]

Chart 8
Cohort size and observed log earnings in the first two full years in Canada, male immigrants age 25 to 64 — Economic class

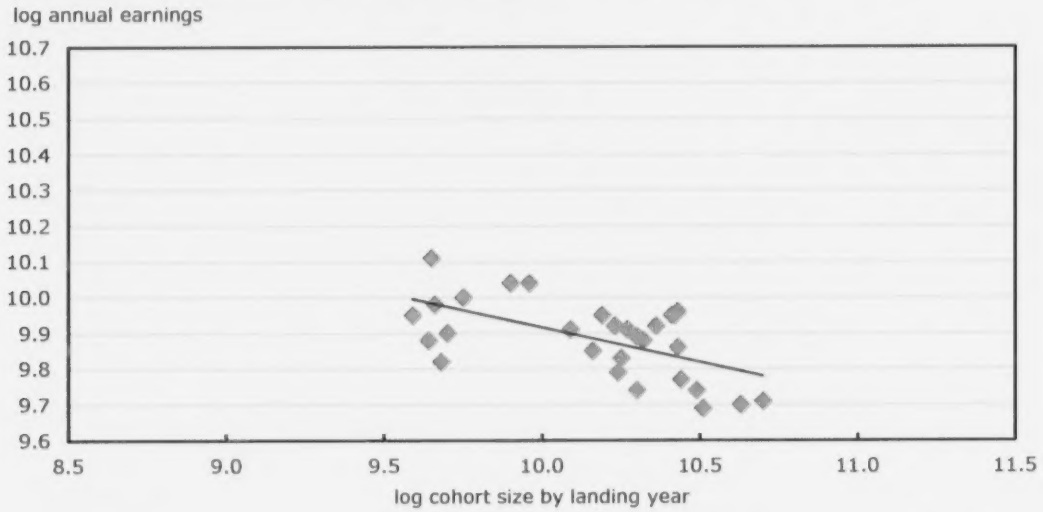


Source: Statistics Canada, Longitudinal Immigration Database, 1982 to 2009.

22. If the residual cohort effect is specified as a linear trend rather than as six five-year periods, a 10% increase in cohort size is associated with a 0.2% decrease in male immigrant earnings. If the quadratic form or cubic form of the residual cohort effects is specified, again the estimated cohort size effect is about 0.2%.

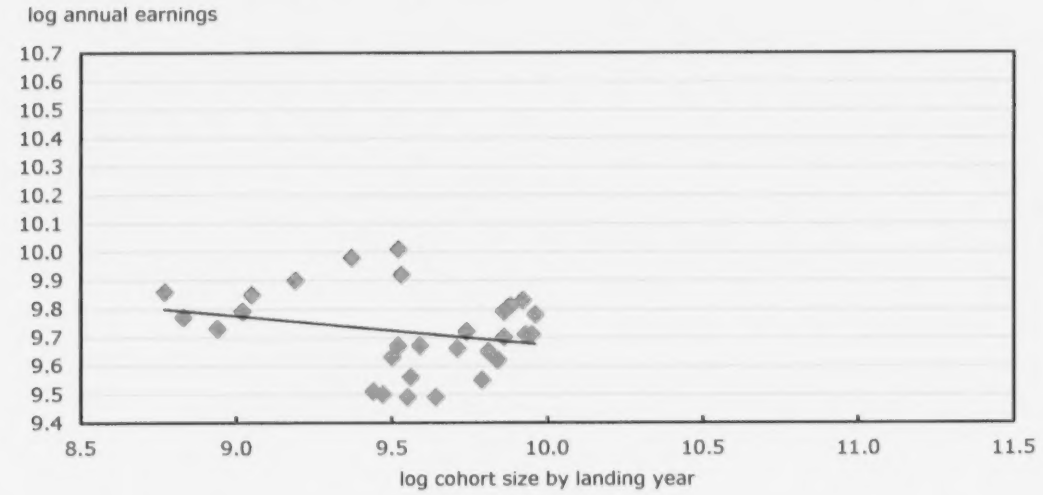
23. About 79% of the variance in the cohort size disaggregated by immigrant class can be accounted for by the six five-year immigrant cohort dummy variables and immigrant class variables. In contrast, 65% of the variance in the cohort size disaggregated by education can be accounted for by the six five-year immigrant cohort dummy variables and immigrant education variables. In other words, controlling for the general cohort effect, the variation in cohort size within immigrant classes is much smaller than the variation in cohort size within three educational levels.

Chart 9
Cohort size and observed log earnings in the first two full years in Canada, male immigrants age 25 to 64 — Family class



Source: Statistics Canada, Longitudinal Immigration Database, 1982 to 2009.

Chart 10
Cohort size and observed log earnings in the first two full years in Canada, male immigrants age 25 to 64 — Refugees



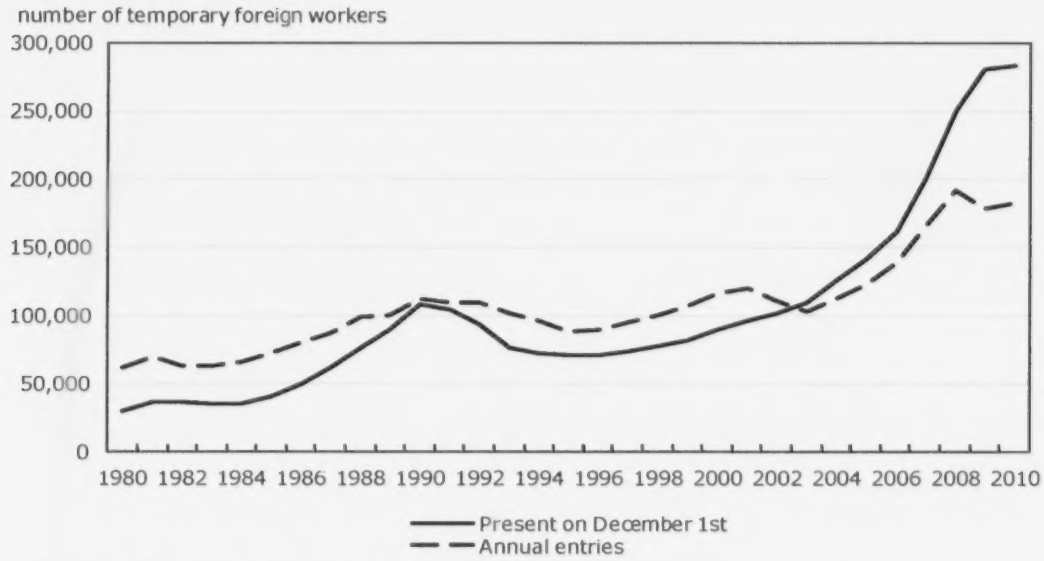
Source: Statistics Canada, Longitudinal Immigration Database, 1982 to 2009.

Another consideration is the potential impact of temporary foreign workers. If these workers compete with landed immigrants for jobs, the appropriate cohort size should perhaps also include temporary workers. This possibility is examined by adding the yearly size of the population of temporary foreign workers by intended province (either yearly entries or the number present by December 1 of each year) to Model 2, Table 1. The effect of this added variable on immigrant earnings is not statistically significant. Its inclusion also does not alter the

effect of immigrant cohort size. This is likely due to the fact that the yearly variation in the number of temporary foreign workers was generally small until 2004 (Chart 11). Put differently, the yearly variation in immigrant earnings is not correlated with the yearly variation in the size of the population of temporary foreign workers. Furthermore, historically landed immigrants tend to cluster in large metropolitan areas, whereas temporary workers are more likely to locate in other regions. This reduces the direct competition for jobs between the two groups.

The analysis to this point is limited to the effect of cohort size on mean entry earnings. Are the results robust across the earnings distribution? Applying Model 2 of Table 1 to various points of the entry earnings distribution, this study finds that the effect of cohort size is rather consistent across the earnings distribution except at the very top where the effect is weaker. For example, among men, a 10% increase in cohort size is associated with a 0.49% decline in entry earnings at the 90th earnings percentile, a 0.82% decline at the 75th percentile, a 0.81% decline at the median, a 0.89% decline at the 25th percentile, and a 0.79% decline at the 10th percentile. Similarly, consistent patterns across the earnings distribution are observed among immigrant women, although the effect of cohort size on entry earnings is smaller than for men, as noted earlier. The smaller effect of cohort size at the very top of the earnings distribution may be because highly paid immigrants are more likely to have the language and other skills needed to compete with Canadian-born workers. Consequently, these highly paid immigrants are less likely to compete mainly with immigrants who arrived in the same cohort.

Chart 11
Trends in the number of temporary foreign workers



Source: Citizenship and Immigration Canada.

5 Conclusion

This study focuses on the effect of immigration levels on one aspect of immigrants' labour market outcomes—their entry earnings. A statistically significant association is found between the size of an entry cohort and entry earnings (during the first two full years in Canada) among prime-working-age immigrants in that cohort. Cohort size is measured as the number of prime-working-age immigrants entering in a particular year and at a given educational level. A 10% increase in cohort size is associated with an average 0.8% decline in real entry earnings among immigrant men in that cohort, and a decline of about 0.3% among immigrant women.[24] These effects are consistent across most of the immigrant entry earnings distribution, although somewhat weaker at the very top. Controls for differences among cohorts in immigrant characteristics, macroeconomic conditions, and residual cohort effects are used in these estimates.

No other papers were found that addressed this issue directly, and hence there are no other estimates with which to compare these results. However, although focusing on the effect of *total* immigrant population, not just of *annual* immigration levels, on wages, earlier work does provide support for the findings in this paper. Card (2009) concluded that within education groups, immigrants and domestic workers are considered imperfect substitutes, and hence immigration levels have relatively little effect on the wages of domestic workers, even though they may affect the wages of other immigrants. Manacorda et al. (2012) also found that the increase in the stock of immigrants in the United Kingdom primarily reduced the wages of immigrants while having little effect on the wages of the domestic-born. The effect of immigration on wages depends in part on who is competing with whom in the labour market. Manacorda et al. concluded that immigrants and the domestic-born are imperfect substitutes. They found this to be particularly true with respect to recent immigrants. Recent immigrants may compete more among themselves than with the domestic-born for jobs. Ottaviano and Peri (2012) arrived at similar results for the United States, concluding that the rise in the number of immigrants significantly reduced the wages of previous immigrants.

The estimated effect of cohort size on entry earnings is not large. However, placing the effect within the context of changes in cohort size since the 1980s can assist with its interpretation. This analysis suggests that the very large increase in immigration levels between the 1980-to-1984 cohort and the 2005-to-2009 cohort would have resulted in a roughly 9% decline in average entry earnings between these two arrival cohorts of immigrant men, and a roughly 3% decline for women. A number of explanations for the declining earnings of immigrants since the early 1980s have been presented in earlier research (Picot and Sweetman 2005).[25] This paper suggests one more possibility, particularly for the university-educated immigrants, whose cohort size increased the most and whose earnings declined the most over recent decades.

Our results also show that the effect of cohort size on entry earnings does not appear to vary with general macroeconomic conditions. Increasing cohort size tends to put downward pressure on immigrant entry earnings similarly in both recessions and economic expansions. This result must be interpreted with care. Immigrant entry earnings are affected by many factors other than cohort size, such as the characteristics of immigrants in an entering cohort and economic conditions. For example, during an economic expansion, an increase in immigration levels does not necessarily mean that immigrant entry earnings will fall. The downward wage pressure of increasing immigration levels may be more than offset by increased earnings associated with

24. As noted in Section 4, on results and robustness, and as is usually the case in econometrics, different model specifications resulted in slightly different parameter estimates. The magnitude of the cohort size effect is an "estimate," considered to be the most reasonable among the alternatives available from various model specifications.
25. There are other factors besides immigrant cohort size that would have affected immigrants entry earnings over these periods.

improving economic conditions, leading to an overall increase in entry earnings among immigrants. Similarly, during a recession, the negative wage effect of deteriorating economic conditions on entering immigrants may be partially offset by a reduction in the entering cohort size.

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